



WO 99/46742

PCT/US99/05372

## LUGGAGE LOCATOR SYSTEM

FIELD OF INVENTION

This invention relates generally to a system for locating luggage or other missing items. More particularly, the invention relates to an apparatus and method for identifying the location of a missing piece of luggage including a transmitter and receiver which employ electronic circuitry.

BACKGROUND OF THE INVENTION

This invention was conceived to solve a common problem experienced by travelers, namely, to have some means for identifying or locating their luggage in a baggage claim area of an airport, bus terminal or the like. Luggage is often confused with similar looking luggage or mistakenly removed from the baggage claim area and moved to another location. It is therefore typical in airports for travelers to have difficulty identifying or finding their luggage.

It is well known to use a miniaturized signal transmitter to activate a battery powered receiver for the purpose of locating a wide range of objects such as automobiles, e.g., U.S. Patent 5,278,556 to Oh, television remote controls, U.S. Patent 5,598,143 to Wentz, U.S. Patent 5,638,050 to Sacca, and U.S. Patent 5,686,891 to Sacca, eyeglasses, U.S. Patent 5,629,677 to Staino, Jr., and other items which are commonly misplaced, U.S. Patent 5,677,673 to Kipnis. Radio frequency transmitters and receivers which emit both light and sound are also commonly used for purposes of locating lost objects, e.g., U.S. Patent 4,101,873 to Anderson, U.S. Patent 4,476,469 to Lander, and U.S. Patent 5,680,105 to Hedrick.

It is also known in the art to apply such radio transmitting technology to luggage. U.S. Patent 5,126,719 to DeSorbo discloses a remotely armed suitcase alarm system.

WO 99/46742

PCT/US99/05372

-2-

The system comprises a remote transmitter unit and a motion sensitive alarm which is attached to the suitcase and includes a signal receiver unit. U.S. Patent 5,043,702 to Kuo discloses an alarm/security device integrated in the luggage which can be remotely activated to produce a siren and an electric shock. U.S. Patent 5,576,692 to Tompkins discloses an airport luggage tracking system which utilizes a beeper paging device and requires a telephone call through a nationwide paging system to locate the luggage.

10 The prior art devices attempt to solve the same general problem of locating luggage by a signal-activated receiver or an alarm transmitter attached to the luggage. However, each has a problem in utilization which makes it relatively unattractive to manufacture or use. Some devices  
15 incorporate costly timer shutoff or battery power saver circuitry in an attempt to conserve power usage and prolong the use time between battery changes. To attract the user's attention, others require a loud alarm or distinctly audible type of sound, such as a loud continuous beeping, which may  
20 be annoying or disturbing to other people in the vicinity. Other devices employ complex triangulation locator circuitry in order to allow a person distant from the object to home in on the object. Still others employ cumbersome encoding circuitry and activation elements to initialize individual  
25 devices for a plurality of objects that might be lost.

Accordingly, it is a broad object of this invention to provide an improved locator device for identifying and locating an object which is inexpensive to produce and operates in a manner that allows the user to  
30 find the tagged object easily. In particular, it is desired that costly timer shutoff or battery power saver circuitry, loud annoying sounds, triangulation locator circuitry, or cumbersome encoding elements are avoided.

It is a further object of this invention to  
35 provide a small transmitting device activated by the push of a button which signals a receiving device attached to or incorporated into a piece of luggage to send out an easily

WO 99/46742

PCT/US99/05372

-3-

identifiable audible and/or visible signal.

#### SUMMARY OF THE INVENTION

In the present invention, these purposes as well as others which will be apparent are achieved generally by providing an inexpensive and easy to use electronic system for locating an object, particularly a piece of luggage, from a remote location.

In accordance with the present invention, an object locator system comprises: a transmitter unit having a casing housing a transmitter circuit therein for outputting an RF signal, and a pushbutton operable externally of the casing and coupled to the transmitter circuit for sending the RF signal only when the pushbutton is pressed; and a receiver unit having a casing provided with attachment means for allowing it to be attached to or incorporated into an object, said casing housing a receiver circuit for receiving the RF signal transmitted by the transmitter unit and outputting an activation signal, and a light illumination element that is illuminated in response to the activation signal, wherein said receiver circuit is operative to output said activation signal only for so long as the RF signal is received from the transmitter unit.

In the preferred embodiment, the light illumination element is a light pipe mounted on the receiver casing and having a length running at least partially around a perimeter of the receiver casing. The casing is formed in two complementary halves, and the light pipe is retained in a recess in the walls of the casing halves. In another embodiment, two light pipes may be employed on opposing sides of the receiver unit.

The transmitter circuit includes a digital oscillator and a means for setting the transmitter circuit to send a unique coded signal, and the receiver circuit includes a digital decoder circuit and a means for setting the receiver circuit to detect the unique coded signal, whereby the receiver unit only responds to the transmitter

WO 99/46742

PCT/US99/05372

-4-

unit sending the unique coded signal. The unique coded signal may be set in the transmitter and receiver circuits either by the user by means of a dip switch array, or the signal may be preset or electronically coded during manufacture, which enables a broader range of coded signals.

5 The receiver casing may be formed with an through-hole at a narrowed end, through which a fastener is inserted for attaching the receiver unit to a selected object. Alternatively, the light illumination element and attachment means may be combined in one element or the receiver casing 10 may be incorporated directly into the selected object. The transmitter unit is formed as a small hand held unit about the size of a key ring. The receiver unit includes a sound generator for generating a sound output in response to the 15 activation signal in cases where the object is out of the user's visual field or hidden from view. The invention also encompasses the related method of sending the RF signal and illuminating the light element only for so long as the RF signal is received from the transmitter unit, in order to 20 provide the user direct visual feedback to the user's pushbutton presses that would make it easy to locate the object in a crowded visual field.

#### DESCRIPTION OF THE DRAWINGS

Figs. 1A, 1B, and 1C are plan, side, and 25 perspective views of a preferred embodiment of a receiver unit in accordance with the present invention.

Figs. 2A and 2B illustrate another embodiment of the receiver unit.

30 Figs. 3A, 3B and 3C illustrate a further embodiment of the receiver unit incorporated into a piece of luggage.

Fig. 4 illustrates an embodiment of a transmitter unit.

35 Fig. 5 is a diagram of an example of a transmitter circuit for the transmitter in accordance with the invention.

WO 99/46742

PCT/US99/05372

-5-

Figs. 6A and 6B are diagrams of an example of a receiver circuit for the receiver unit.

#### DETAILED DESCRIPTION OF THE INVENTION

The object locator system of the present invention is comprised of two units, a transmitter unit that emits an activation signal when a pushbutton is actuated, and a receiver unit that is attached to an object, such as by a chain or loop fastener to the handle of luggage, or incorporated directly into the luggage, which has a light pipe visual indicator that is illuminated in response to receipt of the activation signal. The light pipe provides a flash of illumination each time the user actuates the transmitter, and therefore provides direct visual feedback with each button press by the user. This direct feedback ensures that the user can pick out the light flash in a crowd without the need for a loud alarm or continuous annoying beeping or a triangulation locator device.

Preferably, the light pipe is provided with a length running at least partially around the perimeter of the receiver unit so that it is more visually prominent and can be seen at all angles from the user. The light pipe's length and location may, of course, be altered to present a different market appearance or to allow for different engineering specifications. A digital oscillator circuit with dip switch settings may be used for setting a unique coded signal to be sent by the transmitter, and the receiver circuit may be set in similar fashion with dip switch settings to detect the encoded signal. Alternatively, the transmitter and receiver may be pre-coded with unique signals during manufacture. In these manners, the receiver only responds to its associated transmitter, and each transmitter/receiver pair can be initialized for any one of a plurality of different objects to be located.

In Figs 1A, 1B, and 1C, the receiver unit 10 is shown having a casing 11 with complementary halves 11a, 11b enclosing a circuit board 12 mounting the circuitry for the

WO 99/46742

PCT/US99/05372

-6-

receiver functions, a battery 13, battery connectors 13a, a light emitting diode (LED) 14 and head reflector 14a, an antenna 15, and a speaker 16 behind a grill 16a. The two halves of the casing are attached by a latch or hold down 17 on one end, and a screw fastener 18 on its opposite end. The screw fastener 18 can be removed to allow access into the casing for setting dip switch settings therein, such as for setting the receiver to detect an encoded signal or to select a sound output type (described further herein). The casing can be made of a hard plastic material, such as LEXAN (TM), and molded with a clamshell or ovoid shape to provide a narrowed end by which it is attached to an object such as the handle of luggage. The casing is formed with an through-hole or aperture 19 at its narrowed end, through which a chain, plastic loop, or other type of secure fastener is inserted for attaching the receiver unit to a piece of luggage or other object.

As a principal feature of the invention, a light illumination element 20 is mounted to or on an external surface of the casing so that it is visible to the user. Preferably, the element is a light pipe which has a length running at least partially around the perimeter of the receiver unit, and most preferably running along three sides of the receiver unit. The light pipe is fabricated as a tubular length of light transmissive plastic having an internal index of refraction which results in light rays at low angles of incidence being reflected down the pipe and light at high angles of incidence being transmitted through the pipe walls as external illumination. The light pipe may have tiny reflective particles or a dispersion of bubbles or other reflective elements embedded therein to promote the even dispersion of light along the length of the pipe. The light pipe 20 is retained in a recess 20a formed by an indentation in the facing walls of the casing halves 11a, 11b. A head end 20b of the light pipe 20 is fixed inside the casing 11 facing the LED 14 and reflector 14a, so that light from the LED 14 is directed into and transmitted down

WO 99/46742

PCT/US99/05372

-7-

the light pipe. Preferred LEDs have a rated life expectancy of approximately 50 hours and a power rating of 3.6-4.0 VDC. To provide greater illumination, multiple LEDs may be used to direct light into the light pipe.

5 In Figs. 2A and 2B, another version of the receiver unit has a casing 21 enclosing similar elements as described above for the first embodiment. In this version, the receiver is attached directly to a handle post 22 of a piece of luggage 23 by a threaded post 29 made of light  
10 transmissive plastic material as in the light pipe of the first embodiment. The plastic post 29 is insertable through a hole in one flange 24a of the casing 21 and secured by threading into a fastener hole in another flange 24b of the casing. In the secured position, the end of the post 29 is  
15 positioned adjacent an LED inside the casing, as described above, for directing light into the post. Thus, the illumination element and fastener to the object are combined in one element.

In Figs. 3A, 3B and 3C, a further version of the  
20 receiver unit has a casing 40 enclosing similar elements as described above for the first embodiment. In this version, the receiver is incorporated directly into a side panel 42 of a piece of luggage 44 during manufacture of the luggage, preferably near the handle 45 of the luggage. The casing 40  
25 is mounted between an inner supporting wall 46 and an outer covering 48 of the top side panel 42 and secured by inserting screws, rivets or the like through the outer covering and into the holes 47 provided in the casing. In this manner, the receiver unit may be incorporated into both  
30 hard and soft cover luggage. The casing 40 includes two flanges 52a, 52b which extend out of opposing sides of the casing and have portions 50a, 50b made of light transmissive plastic material as in the light pipe of the first embodiment. The flanges 52a, 52b are adjustable to extend  
35 the width of the luggage, such that each light pipe is visible on opposing sides of the luggage. Alternatively, the light pipes 50a, 50b may be located on a top surface of



WO 99/46742

PCT/US99/05372

-8-

each flange 52a, 52b and may extend through apertures out into the outer covering 48. Each flange 52a, 52b is positioned adjacent an LED inside the casing, as described above, for directing light into the flange and toward the light pipes 50a, 50b. Thus, this embodiment may utilize two LEDs. A sound producing device is also mounted in the casing behind a grill 54.

As shown in Fig. 4, the transmitter is a small hand held unit 30 about the size of a key ring which can be easily carried by the owner and/or unobtrusively attached to a variety of objects such as a key ring. The transmitter casing encloses transmitter circuitry, a battery power source, and an antenna, in a similar manner as described for the receiver unit. The casing can be opened to allow access for setting dip switch settings therein, such as for setting the transmitter to send a particular encoded signal (described further herein). An activation button 31 is mounted on an external side of the casing for convenient operation by the user. Activation of the transmitter results in sending an encoded radio frequency (RF) signal. The RF signal for the indicated size and battery capacity of the transmitter typically would have an effective range of about 50-100 feet. The transmitter may also include an LED which is illuminated upon activation of the transmitter, to confirm to the user that the transmitter is functioning properly.

A unique aspect of the present invention is the activation of the receiver, upon receipt of a signal from the transmitter, to emit light through the light pipe in response to the user depressing the activation button on the transmitter. The user can thus activate a series of light flashes of arbitrary duration by depressing the transmitter button on and off at will. When the user scans an area where the object might be found, the visual perception of light flashes being emitted in direct response to the user's button presses provides a direct visual feedback to the user that makes it easy to pick out the flashes in a crowded

WO 99/46742

PCT/US99/05372

-9-

visual field, and thereby locate the object. This direct feedback makes it unnecessary to have the receiver emit a loud or distinctly audible sound that would annoy other persons.

5 The embodiments described herein are also provided with a sound speaker or piezzo-electric sound element that is operated at lower audible levels that would be tolerable to passers-by, such as a warbling or chirping sound. The sound output can assist the user in the event the object is  
10 located nearby but out of the user's visual field, such as behind the user or in a compartment or area shielded from the user's sight.

By activating the receiver to emit light only when the transmitter signal is sent, and with low speaker levels,  
15 the system of the present invention also conserves the receiver's battery power without the need for complicated power shutoff or timer circuitry. The light pipe also provides an aesthetic element to the locator device that would make it more attractive to users.

20 In Fig. 5, an example of a circuit for the transmitter is shown having a battery input BAT, a pushbutton switch S2, a driver transistor Q3, a digital oscillator unit OSC, an array of dip switch S1, and an RF output circuit including an inductor element L1. The array  
25 of dip switches S1 has 8 bit positions for setting a unique binary number to be coded with the transmitted signal. In this manner, the transmitter is set to locate only the object that has a receiver set to detect the encoded signal. An array of 8 dip switches provides capability of setting up  
30 to 256 unique coded signals. The battery may be a 12V battery with a service life of 2000 hours (about 3 months) in stand by mode. The RF circuit generates an RF signal at 315 MHz and at a power level sufficient for a typical 50 -  
100 foot range for locating an object. The digital  
35 oscillator can be a unit such as one manufactured under the part number HT12E by Holtek Corp.

WO 99/46742

PCT/US99/05372

-10-

In Fig. 6A, an example of a circuit for the receiver is shown having an antenna circuit including an antenna element ANT1, a signal passing circuit including transistor Q7, an analog-to-digital conversion circuit including multivibrators U2A and U2B, a digital decoder unit DEC, an array of dip switches S1, and a light emitting diode LED. The array of dip switches S1 has 8 bit positions for setting the unique binary number matched to that coded in the transmitter for detecting of the transmitted signal intended for that receiver. The battery power supply for the receiver can be a 9V battery with a service life of 2000 hours (about 3 months) in stand by mode. The digital decoder can be a unit such as one manufactured under the part number HT12F by Holtek Corp.

In Fig. 6B, an example of a sound generator circuit for the receiver is shown having a buzzer input BUZZER (from an output of the digital decoder unit, a switch S2, a digital sound signal generator unit U4, and a piezoelectric sound element U3. The switch S2 is set to select from up to four types of sound output signals. The digital sound signal generator can be a unit such as one manufactured under the part number TS3V555 by Motorola Corp. Alternatively, a sound speaker unit may be used to provide a broader sound range.

It will be recognized by those skilled in the art that the locator system of the invention has wide application for use in identifying and locating missing objects, and that numerous modifications are possible in light of the above disclosure. For example, the size, shape and color of the transmitter and receiver units, as well as the size, shape, color and location of the light pipe, may be modified in any number of ways to present a different marketing presentation or to accommodate different engineering specifications. Further, other types of signal transmission may be used, such as infrared, sonic and ultrasonic, and any known electronic circuit designs may be used for generating, transmitting and receiving such



**WO 99/46742**

**PCT/US99/05372**

- 12 -

I CLAIM:

1. An object locator system comprising:  
a transmitter unit having a casing housing a transmitter circuit therein for outputting an RF signal, and  
5 a pushbutton operable externally of the casing and coupled to the transmitter circuit for sending the RF signal only when the pushbutton is pressed; and  
a receiver unit having a casing provided with attachment means for allowing it to be attached to an object, said casing housing a receiver circuit for receiving  
10 the RF signal transmitted by the transmitter unit and outputting an activation signal, and a light illumination element that is illuminated in response to the activation signal, wherein said receiver circuit is operative to output  
15 said activation signal only for so long as the RF signal is received from the transmitter unit.
2. An object locator system according to Claim 1, wherein said light illumination element is a light pipe mounted on an external part of the receiver casing and  
20 having a length running at least partially around a perimeter of the external part of the receiver unit.
3. An object locator system according to Claim 2, wherein said casing is formed in two complementary halves, and said light pipe is retained in a recess formed by an  
25 indentation in the facing walls of the casing halves.
4. An object locator system according to Claim 2, wherein said light pipe has a head end fixed inside the casing facing a light emitting diode element housed therein.
5. An object locator system according to Claim 1,  
30 wherein said transmitter circuit includes a digital oscillator and a dip switch array for setting the transmitter circuit to send a unique coded signal, and the

WO 99/46742

PCT/US99/05372

-13-

receiver circuit includes a digital decoder circuit and dip switch array for setting the receiver circuit to detect the unique coded signal, whereby the receiver unit only responds to the transmitter unit sending the unique coded signal.

5           6. An object locator system according to Claim 1, wherein said casing is formed with an through-hole at its narrowed end through which a fastener is inserted for attaching the receiver unit to a selected object.

10           7. An object locator system according to Claim 1, wherein said light illumination element and said attachment means are combined in one element.

          8. An object locator system according to Claim 1, wherein said transmitter unit is a small hand held unit about the size of a key ring.

15           9. An object locator system according to Claim 1, wherein said receiver unit further comprises a sound generator circuit and a sound speaker for generating a sound output in response to the activation signal.

20           10. An object locator system according to Claim 9, wherein said sound generator circuit is operable to generate sound only for so long as the RF signal sent by the transmitter unit is received by the receiver unit.

          11. A method of locating an object by RF signal comprising the steps of:  
25           transmitting from a transmitter unit an RF signal by actuating a pushbutton only for so long as the pushbutton is actuated;

          receiving at a receiver unit, provided with attachment means for allowing it to be attached to or  
30           incorporated into an object, the RF signal transmitted by the transmitter unit and outputting an activation signal,

WO 99/46742

PCT/US99/05372

-14-

activating a light illumination element provided with said receiver unit only for so long as the activation signal is generated,

whereby, when a user scans an area where an object  
5 having the receiver unit attached to it might be found, a visual perception of light flashes being emitted in direct response to the user's pushbutton presses provides a direct visual feedback to the user that makes it easy to pick out the flashes in a crowded visual field, and thereby locate  
10 the object.

12. An object locating method according to Claim 11, wherein said light illumination element is a light pipe mounted on an external part of the receiver unit and having a length running at least partially around a perimeter of  
15 the receiver unit.

13. An object locating method according to Claim 11, wherein said transmitter unit includes a digital oscillator and a dip switch array for setting the transmitter circuit to send a unique coded signal, and the  
20 receiver unit includes a digital decoder circuit and dip switch array for setting the receiver circuit to detect the unique coded signal, whereby the receiver unit only responds to the transmitter unit sending the unique coded signal.

14. An object locating method according to Claim 25 11, wherein said light illumination element and said attachment means are combined in one element.

15. An object locating method according to Claim 11, wherein said receiver unit comprises a sound generator circuit and a sound speaker for generating a sound output in  
30 response to the activation signal only for so long as the RF signal sent by the transmitter unit is received by the receiver unit.

WO 99/46742

PCT/US99/05372

-15-

16. A system for locating a piece of luggage having four side enclosing panels, which comprises:

5 a transmitter unit having a casing housing a transmitter circuit therein for outputting an RF signal, and a pushbutton operable externally of the casing and coupled to the transmitter circuit for sending the RF signal only when the pushbutton is pressed; and

10 a receiver unit having a casing provided with attachment means for allowing it to be incorporated directly into one of the side enclosing panels, said casing housing a receiver circuit for receiving the RF signal transmitted by the transmitter unit and outputting an activation signal, and a light illumination element that is illuminated in response to the activation signal, wherein said receiver  
15 circuit is operative to output said activation signal only for so long as the RF signal is received from the transmitter unit.

17. A system for locating luggage according to Claim 16, wherein the casing of the receiver unit comprises  
20 a flange extending from a side of the casing and the light illumination element comprises a light pipe mounted on an outer surface of the flange.

18. A system for locating luggage according to Claim 17, wherein the casing of the receiver unit is mounted  
25 to a top side panel of the luggage such that the light pipe extends to an outer edge of the side panel.

19. A system for locating luggage according to Claim 17, wherein two flanges extend from opposing sides of the casing, each of the flanges having a light pipe mounted  
30 on an outer surface thereof.



WO 99/46742

PCT/US99/05372

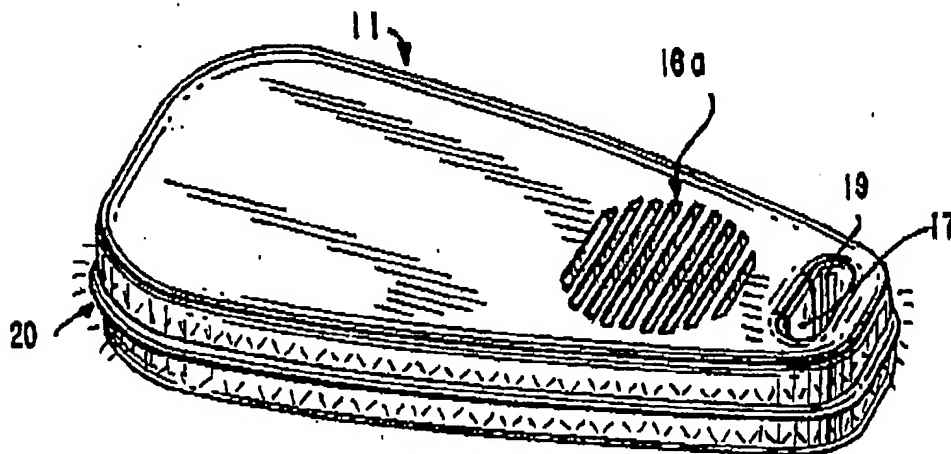
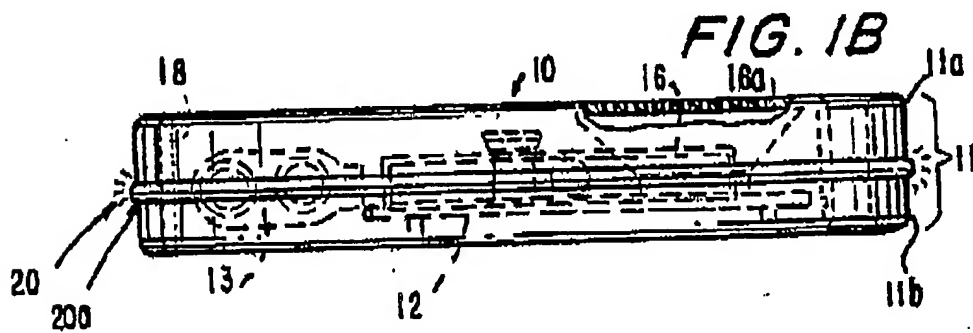
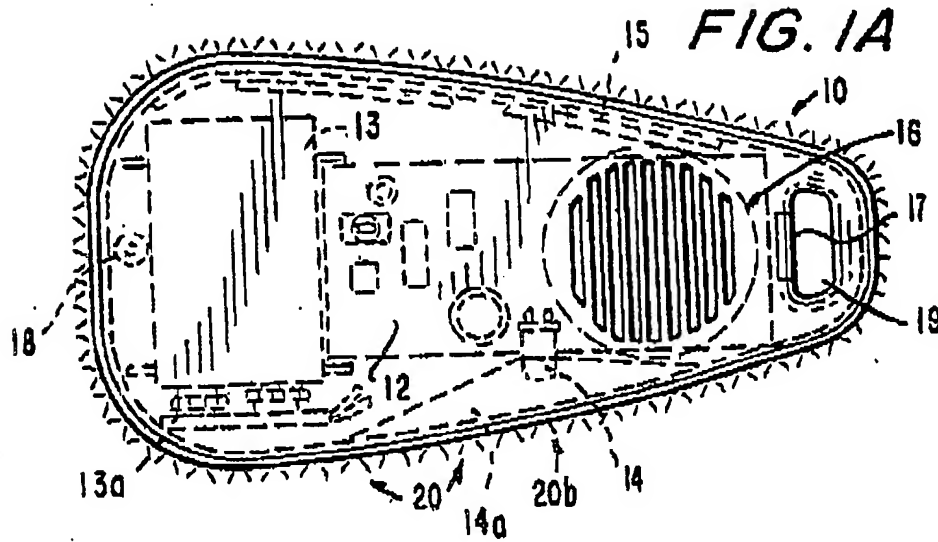
-16-

20. A system for locating luggage according to Claim 19, wherein the casing of the receiver unit is mounted to a top side panel of the luggage such that the light pipe mounted on each of the flanges extends to an outer edge of  
5 the side panel.

WO 99/46742

PCT/US99/05372

1 / 6



WO 99/46742

PCT/US99/05372

2/6

FIG. 2A

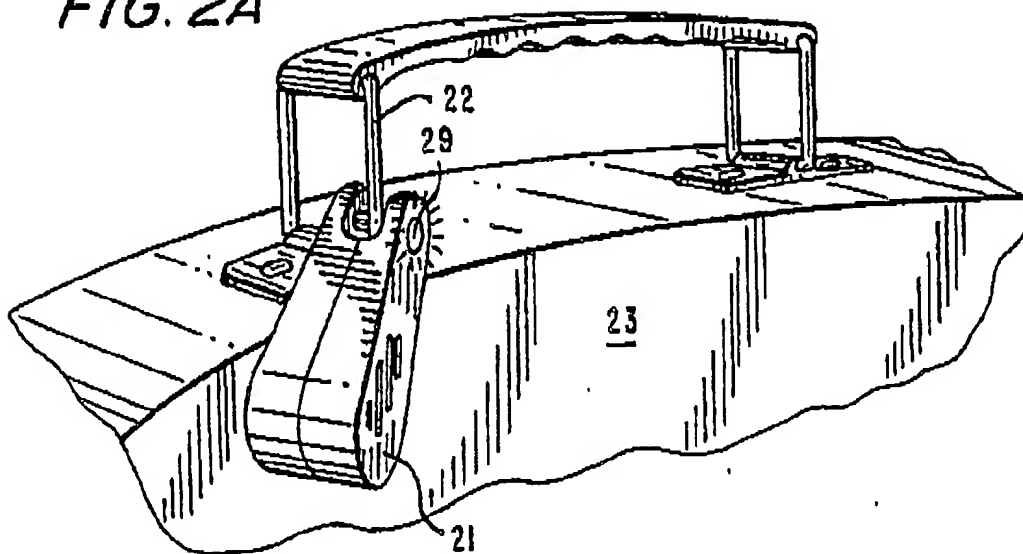
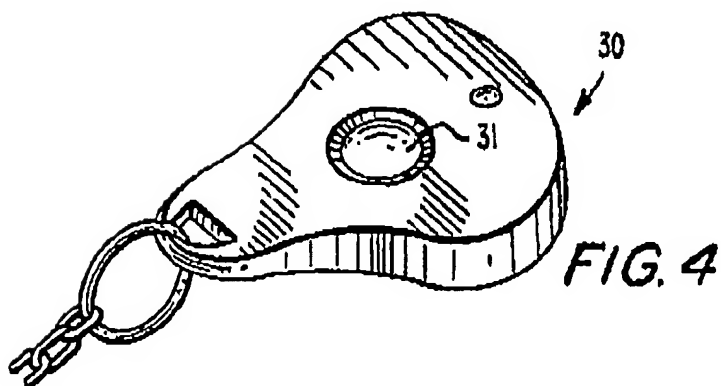
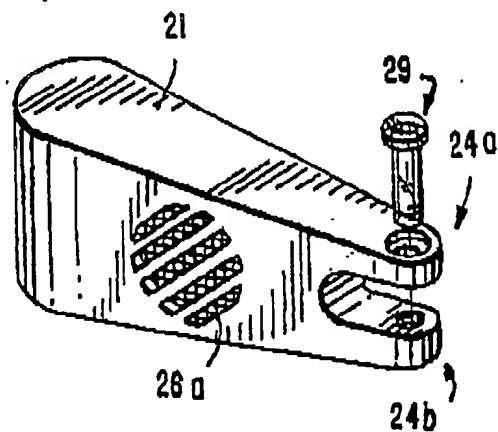


FIG. 2B



WO 99/46742

PCT/US99/05372

3/6

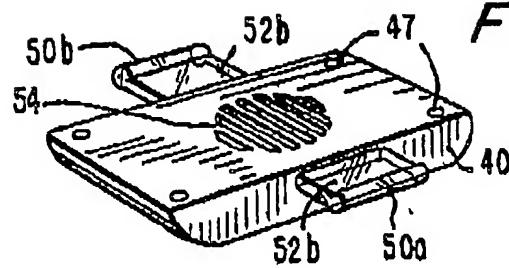


FIG. 3A

FIG. 3B

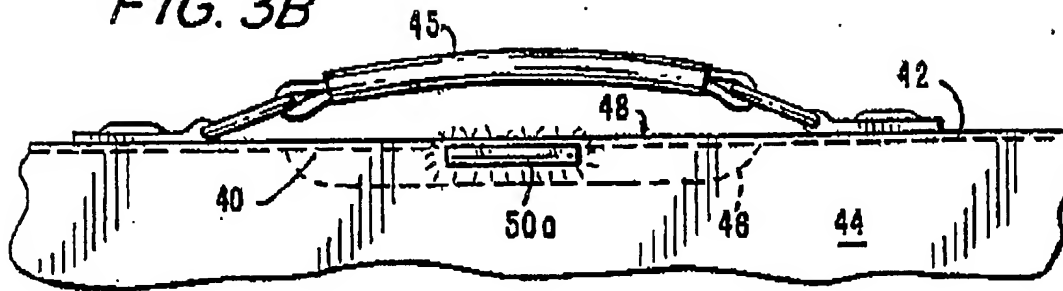
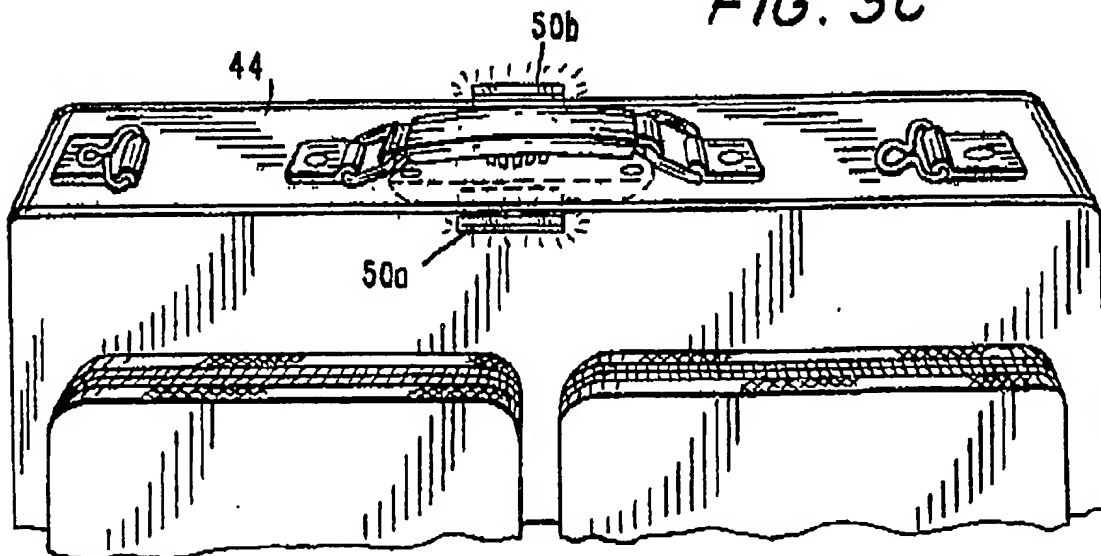


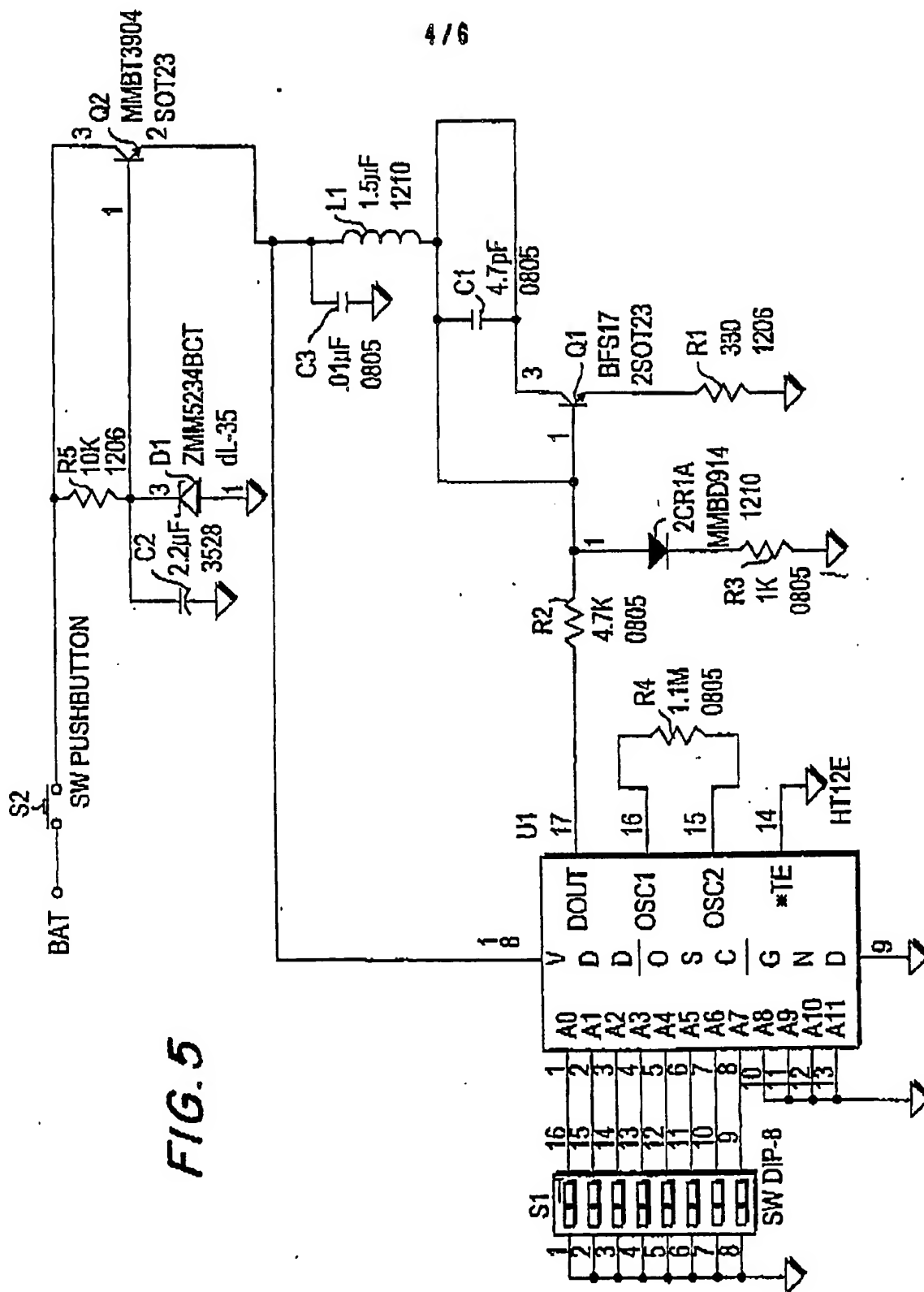
FIG. 3C



**WO 99/46742**

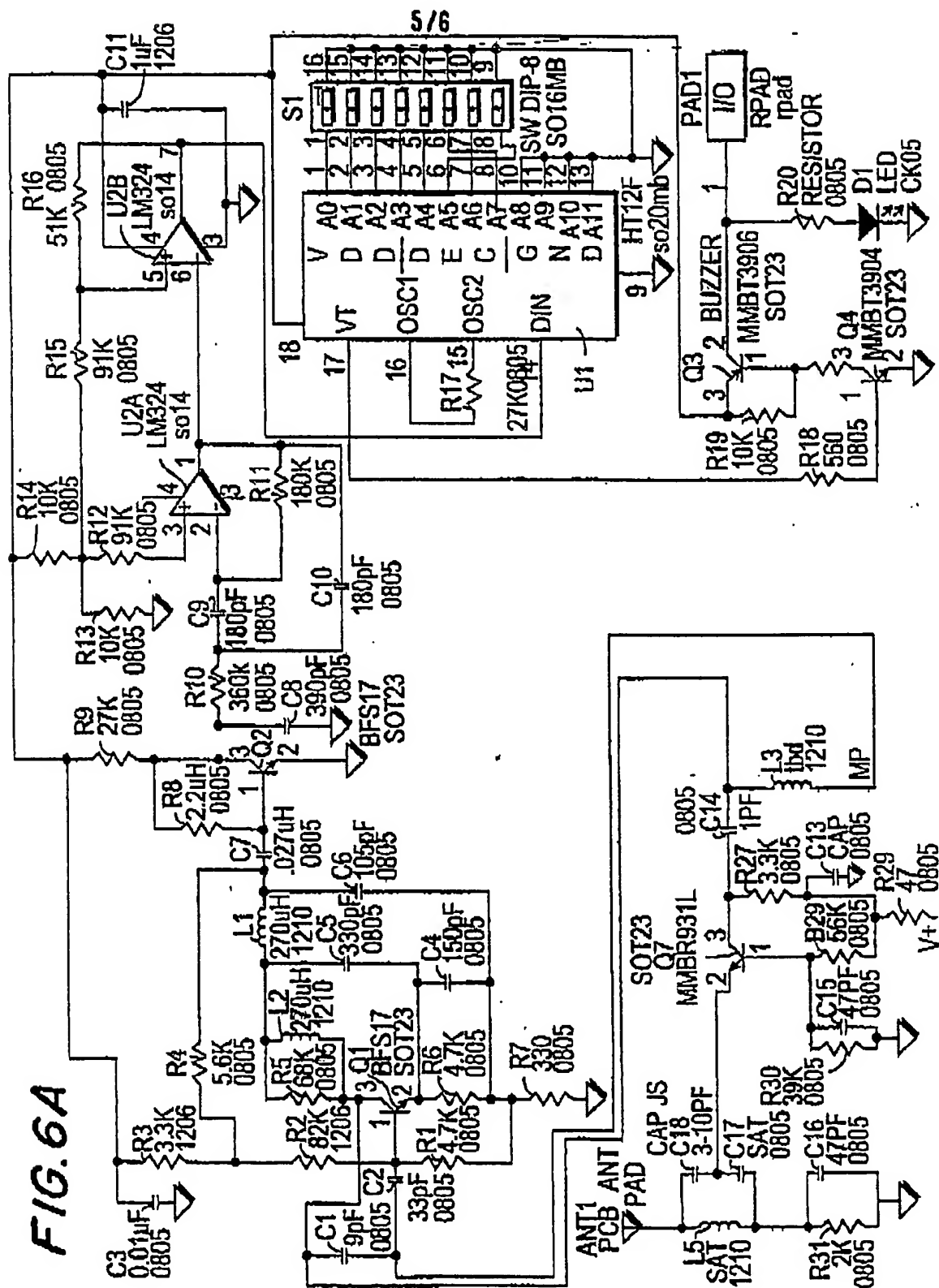
**PCT/US99/05372**

4/6



**WO 99/46742**

**PCT/US99/05372**



WO 99/46742

PCT/US99/05372

6/ 8

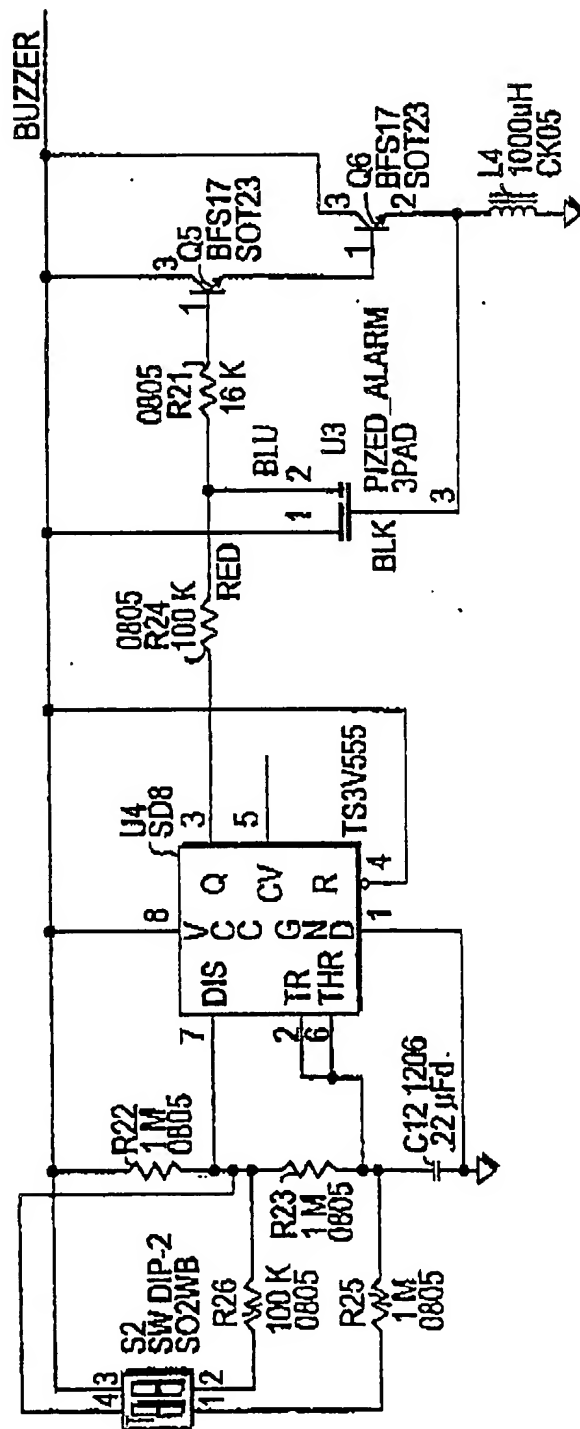


FIG. 6B

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US99/05372

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : G03B 5/22, 13/14,  
US CL : 340/568.1

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 340/539, 568.1, 568.6, 571, 825.34, 825.36, 825.49

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS IMAGE, DIALOG, JPO

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3,665,313 A (TRENT) 23 May 1972, see Abstract and Figs. 2 and 4.	1, 5, 7, 9-11, 13-15
X	US 4,476,469 A (LANDER) 09 October 1984, see Abstract and Figs. 1-9.	1, 5-11, 13-15
X	US 4,814,742 A (MORITA et al.) 21 March 1989, see Abstract and Fig. 7.	1, 5-11, 13-15
X	US 5,673,023 A (SMITH) 30 September 1997, see Abstract and Figs. 1-5.	1, 5-11, 13-15
X	US 5,680,105 A (HEDRICK) 21 October 1997, see Abstract and Figs. 1-4.	1, 3-11, 13-15

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

Special categories of cited documents:	
*A* document defining the general state of the art which is not considered to be of particular relevance	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*B* earlier document published on or after the international filing date	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
*L* document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
*O* document referring to an oral disclosure, use, exhibition or other means	*Z* document members of the same patent family
*P* document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

03 MAY 1999

Date of mailing of the international search report

19 MAY 1999

Name and mailing address of the ISA/US  
Commissioner of Patents and Trademarks  
Box PCT  
Washington, D.C. 20231  
Facsimile No. (703) 305-3230

Authorized officer

DANIEL J. WU

Telephone No. (703) 305-6730



**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**